

## CLAIMS

What is claimed is:

1        1. A resonator device configured with an input port at one end and a  
2 termination at its other end, and for providing a frequency selective element for an  
3 oscillator, the device comprising:

4              a substrate; and

5              a fractional wavelength transmission line on a surface of the substrate, and formed  
6              into one or more loops thereby providing a looped-stub resonator structure,  
7              wherein each edge or side of the one or more loops provides a portion of the  
8              fractional wavelength.

1        2. The device of claim 1 wherein the termination is one of a capacitor, a short  
2 circuit, or an open circuit.

1        3. The device of claim 1 wherein the device is a structure having a number of  
2 layers, and the transmission line is located in an inner layer of the structure.

1        4. The device of claim 3 wherein the inner layer is substantially surrounded by  
2 dielectric insulating material layers.

1        5. The device of claim 4 wherein electrically conducting material layers  
2 connected to ground surround the dielectric insulating material layers.

1        6. The device of claim 1 wherein the device is incorporated into a voltage  
2 controlled oscillator of a phase locked loop circuit.

1        7. The device of claim 1 wherein the looped-stub resonator is a metal pattern  
2 formed on the substrate, and changes in oscillation frequency are accomplished by  
3 physically changing the metal pattern.

1       8.     The device of claim 1 wherein the looped-stub resonator is formed on the  
2 substrate as a metal pattern that includes a capacitive termination, and changes in  
3 oscillation frequency are accomplished by physically changing the capacitive termination.

1       9.     A phase locked loop module comprising:  
2              a voltage controlled oscillator circuit; and  
3              a fractional wavelength looped-stub resonator operatively coupled to the voltage  
4              controlled oscillator circuit and having one or more loops, with each edge or  
5              side of the one or more loops providing a portion of the fractional  
6              wavelength, the resonator for providing a frequency selective element for  
7              the voltage controlled oscillator circuit.

1       10.    The module of claim 9 wherein the looped-stub resonator has a Q of 100 or  
2 greater.

1       11.    The module of claim 9 wherein the voltage controlled oscillator circuit and  
2 the looped-stub resonator are located on a common substrate.

1       12.    The module of claim 9 wherein the voltage controlled oscillator circuit and  
2 the looped-stub resonator are located on different substrates.

1       13.    The module of claim 9 wherein the module includes a number of layers and  
2 the looped-stub resonator is located on a layer that is above a dielectric insulation layer.

1       14.    The module of claim 13 wherein the dielectric insulation layer is located  
2 above an electrically conducting material layer that is connected to ground.

1       15.    The module of claim 9 wherein the looped-stub resonator is terminated with  
2 one of a capacitor, a short circuit, or an open circuit.

1       16.    The module of claim 9 wherein the looped-stub resonator is a metal pattern  
2 on a substrate, and changes in oscillation frequency are accomplished by physically  
3 changing the metal pattern.

1        17. The module of claim 9 wherein the looped-stub resonator is on a substrate  
2        as a metal pattern that includes a capacitive termination, and changes in oscillation  
3        frequency are accomplished by physically changing the capacitive termination.

1        18. The module of claim 9 wherein the looped-stub resonator has a resonant  
2        frequency higher than an output frequency of the module.

1        19. The module of claim 18 wherein one or more frequency dividers are used to  
2        reduce the resonant frequency to the output frequency.

1        20. A phase locked loop module comprising:  
2              a first layer having a voltage controlled oscillator circuit;  
3              a second layer of dielectric insulating material covered with a conducting metal that  
4              is connected to a ground plane;  
5              a third layer having a fractional wavelength looped-stub resonator operatively  
6              coupled to the voltage controlled oscillator circuit and having one or more  
7              loops, with each edge or side of the one or more loops providing a portion  
8              of the fractional wavelength, the resonator for providing a frequency  
9              selective element for the voltage controlled oscillator circuit; and  
10             a fourth layer of dielectric insulating material covered with a conducting metal that  
11             is connected to the ground plane;  
12             wherein the third layer is surrounded by the dielectric insulating material of the  
13             second and fourth layers.

1        21. The module of claim 20 further comprising:  
2              an additional layer of dielectric insulating material on the conducting metal of the  
3              second layer to prevent unintended short-circuiting between the first layer  
4              and the second layer.

1        22. The module of claim 20 wherein the looped-stub resonator has a resonant  
2        frequency higher than an output frequency of the module.

- 1           23. The module of claim 22 wherein one or more frequency dividers are used to  
2 reduce the resonant frequency to the output frequency.